# Spécialité de Master « Optique, Matière, Plasmas »

*Stage de recherche (4 mois minimum, à partir de début mars)*

## Proposition de stage

*Date de la proposition: 27 novembre 2012*

| **Responsable du stage** / *internship supervisor*: | | | |
|---|---|---|---|
| Nom / *name*: | Ros | Prénom/ *first name* : | David |
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| Courriel / *mail*: | david.ros@u-psud.fr | | |
| **Nom du Laboratoire** / *laboratory name*: | Laboratoire Physique des Gaz et des Plasmas (LPGP) | | |
| Code d'identification : | UMR8578 | Organisme : | Université Paris Sud |
| Site Internet / *web site*: http://www.laserix.u-psud.fr | | | |
| Adresse / *address: LASERIX/LOA - ENSTA,* Chemin de la Hunière ~ 91761 PALAISEAU cedex, France | | | |
| Lieu du stage / *internship place*: LASERIX - LPGP | | | |

**Titre du stage** / *internship title:* Sub-10nm coherent laser source based injection-seed soft-x-ray amplifier

The increasing interest for bright soft-x-ray laser (SXRL) pulses greatly exceeds the beam time available at a few single-user free-electron laser facilities in the world [1]. This motivates the development of compact and accessible SXRLs at the laboratory scale for broad range of experiment such preparation for large scale access to solid state physics, biology and plasma physics. Significant progress has been achieved in the past few years in the development of compact plasma-based soft-x-ray lasers. However, repetitive operation of tabletop SXRLs has been limited to wavelengths in the range of 10-20 nm [2]. At shorter wavelengths, the large pump energy required has limited the repetition rate to typically one shot per hour [3] Recently, with unprecedentedly low total pump energy of 7J saturated picosecond SXRL pulses at 8.85 nm were demonstrated by researcher from NSF Engineering Research for EUV in the Colorado State University [4].
The LASERIX facility aims to deliver XUV to IR beam. The SXRL beam lines are based on high peak power chirped pulse amplification Ti:Sapphire laser system which delivers up to 15J @ 0.4Hz or 3J @ 10Hz. Injection seed-experiment are performed at high repetition rate in the range of 10-20nm on a existing beam line.
For the training period, the student will participate to the experiment on a particular injection-seeding configuration and full beam characterization at high repetition rate in the range 10-20nm [5]. The development of such sources required varied field of skills from plasma physics, laser, ultrafast optics and engineering to non-linear optics and atomic physics. The first 4-month of research training build up a perfect introduction for a PhD based on the development of new sub-10nm coherent laser source based on injection-seed soft-x-ray amplifier.

For more information on the facility visit: http://www.laserix.u-psud.fr

Bibliography (available on request)

1. W. J. McNeil and N. R. Thompson, X-Ray Free- Electron Lasers, Nat. Photon. 4, 814 (2010) and W. Ackermann et al., Operation of a Free-Electron Laser from the Extreme Ultraviolet to the Water Window, Nat. Photon. 1, 336 (2007).
2. S. Kazamias et al. Physical Review A, Vol. 77, Iss. 3 (2008) and K. Cassou et al. Optics Letters, Vol. 32, Issue 2 (2007)
3. H. Daido et al., Efficient Soft X-Ray Lasing at 6–8 nm in Nickel-like Lanthanides, Phys. Rev. Lett. 75, 1074 (1995).
4. D. Alessi et al., Phys. Rev. X, 1, 2, 021023 (Sept. 27, 2011)
5. S. Daboussi et al. Applied Phys. B. (2012)

| **Ce stage pourra-t-il se prolonger en thèse ?** *Possibility of a PhD* **? : Oui / Yes** |
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| **Si oui, financement de thèse envisagé/** *financial support for the PhD***: EDOM** |

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| Lasers et matière | **x** | Lumière, Matière : Mesures Extrêmes | **x** |
| Optique de la science à la technologie | **x** | Plasmas : de l'espace au laboratoire | **x** |